Big Ideas Math: Geometry

Chapter Summary

Chapter 8: Similarity

Learning Goals

Use similarity statements.

Find corresponding lengths in similar polygons.

Find perimeters and areas of similar polygons.

Decide whether polygons are similar.

Use the Angle-Angle Similarity Theorem.

Solve real-life problems.

Use the Side-Side-Side Similarity Theorem.

Use the Side-Angle-Side Similarity Theorem.

Prove slope criteria using similar triangles.

Use the Triangle Proportionality Theorem and its converse.

Use other proportionality theorems.

Standards

Common Core:
HSG-SRT.A.2, HSG-SRT.A.3, HSG-SRT.B.4, HSG-SRT.B.5, HSG-MG.A.1, HSG-MG.A.3, HSG-GPE.B.5, HSG-GPE.B.6

Essential Questions

How are similar polygons related?

What can you conclude about two triangles when you know that two pairs of corresponding angles are congruent?

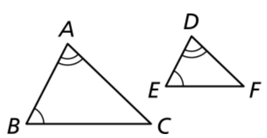
What are two ways to use corresponding sides of two triangles to determine that the triangles are similar?

What proportionality relationships exist in a triangle intersected by an angle bisector or by a line parallel to one of the sides?

Core Concept

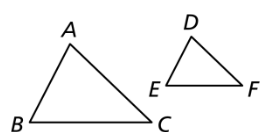
Triangle Similarity Theorems

AA Similarity Theorem



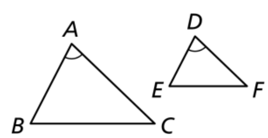
If $\angle A \cong \angle D$ and $\angle B \cong \angle E$, then $\triangle ABC \sim \triangle DEF$.

SSS Similarity Theorem



If $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$, then $\triangle ABC \sim \triangle DEF$.

SAS Similarity Theorem



If $\angle A \cong \angle D$ and $\frac{AB}{DE} = \frac{AC}{DF}$, then $\triangle ABC \sim \triangle DEF$.

Theorems

8.1 Perimeters of Similar Polygons
If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding side lengths.

8.2 Areas of Similar Polygons
If two polygons are similar, then the ratio of their areas is equal to the squares of the ratios of their corresponding side lengths.

8.3 Angle-Angle (AA) Similarity Theorem
If two angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar.

8.4 Side-Side-Side (SSS) Similarity Theorem
If the corresponding side lengths of two triangles are proportional, then the triangles are similar.

8.5 Side-Angle-Side (SAS) Similarity Theorem
If an angle of one triangle is congruent to an angle of a second triangle and the lengths of the sides including these angles are proportional, then the triangles are similar.

8.6 Triangle Proportionality Theorem
If a line parallel to one side of a triangle intersects the other two sides, then it divides the two sides proportionally.

8.7 Converse of the Triangle Proportionality Theorem
If a line divides two sides of a triangle proportionally, then it is parallel to the third side.

8.8 Three Parallel Lines Theorem
If three parallel lines intersect two transversals, then they divide the transversals proportionally.

8.9 Triangle Angle Bisector Theorem
If a ray bisects an angle of a triangle, then it divides the opposite side into segments whose lengths are proportional to the lengths of the other two sides.

Core Concept

Corresponding Parts of Similar Polygons

In the diagram below, $\triangle ABC$ is similar to $\triangle DEF$. You can write "$\triangle ABC$ is similar to $\triangle DEF$" as $\triangle ABC \sim \triangle DEF$. A similarity transformation preserves angle measure. So, corresponding angles are congruent. A similarity transformation also enlarges or reduces side lengths by a scale factor k. So, corresponding side lengths are proportional.

Corresponding angles

$\angle A \cong \angle D$, $\angle B \cong \angle E$, $\angle C \cong \angle F$

Ratios of corresponding side lengths

$$\frac{DE}{AB} = \frac{EF}{BC} = \frac{FD}{CA} = k$$

Corresponding Lengths in Similar Polygons

If two polygons are similar, then the ratio of any two corresponding lengths in the polygons is equal to the scale factor of the similar polygons.

What's the Point?

The STEM Videos available online show ways to use mathematics in real-life situations.

The Chapter 8: Scale Model of a Pool STEM Video is available online at www.bigideasmath.com.

Additional Review

- Proving Slope Criteria Using Similar Triangles, *p. 439*